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Saturn's tilted rings reveal mysterious color variations

Composite images of Saturn's rings, taken by NASA's Hubble Space Telescope, have revealed mysterious color variations that hint that the rings could be made of materials from the outer solar system. These new findings are important because scientists have long questioned whether the rings originated around Saturn, like the planet's retinue of icy moons, or elsewhere.

The Hubble images, captured by a team of scientists between 1996 and 2000, show Saturn's rings from beneath in a wide-open or "tilted" viewpoint from Earth, as the planet's Northern Hemisphere swings from autumn toward winter. When seen edge-on, Saturn's rings, which are only some tens of meters thick, nearly disappear from view. The composite images, which were released recently by the Hubble Heritage Program, can be accessed at: http://heritage.stsci.edu

"The color of the ring material can help tell us what the rings are made of and will help decipher their origin," said Ames' Jeff Cuzzi, a member of the Hubble team. The color variations indicate that different materials make up the rings. The distribution of the materials provides information about the processes that shaped the rings, he explained.

"Most people don't know that Saturn's rings aren't white but have a faint salmon color, which hints that a few percent of complex organic molecules are mixed in with the water ice the rings are mostly made of," Cuzzi said. Saturn's seven small icy moons don't have such a reddish color, but many icy objects in the frozen reaches of the outer solar system do, he explained. This leads scientists to suspect that, unlike the moons, the rings were formed from an outer solar system object. This object, they think, careened too close to Saturn and—like comet Shoemaker-Levy 9 in 1994—was torn apart by the massive planet's gravity, leaving a trail of debris.

Over 100 Hubble images were analyzed in eight different colors that cover, and go beyond, the range of human vision. They include violet, blue, green and red in the visible range and ultra-violet and infrared in the non-visible range.

Cuzzi also has shown that there appear to be at least two unknown materials mixed with the rings' water ice, and that the way these materials are distributed in the rings is unlike anything seen on the surfaces of nearby planets or satellites. For example, in some rings the color gets redder closer to Saturn, and in others, the color trend reverses in the middle of the ring. In some places, the color gets redder where the concentration of particles increases, and in other places it gets redder where the concentration of particles decreases. Scientists hope to explain these variations in terms of how the composition of the ring material was initially distributed, and how it has evolved with time.

"The Hubble data also show that the ring color changes with viewing angle. The best explanation," said Francois Poulet of Ames, who is working with Cuzzi, "is that the ring particles are actually lumpy aggregates of particles, with many more deep shadows than the relatively smooth surface of a moon or asteroid." The lit parts of the "lumpy" surface partly illuminate the shadows with their reddish color, so the rings appear redder as more shadows are seen.

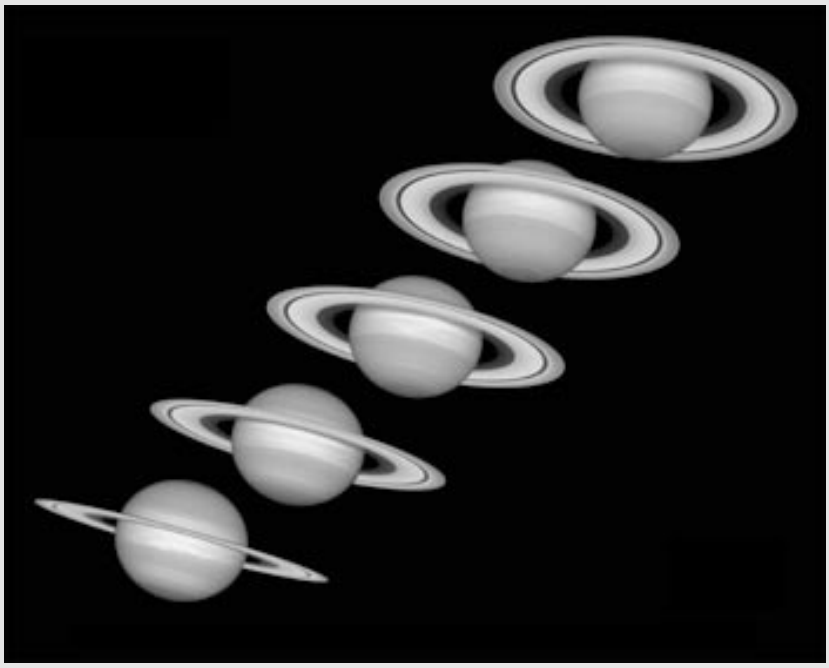

Image credit: NASA and The Hubble Heritage Program

Looming like a giant flying saucer in our outer solar system, Saturn puts on a show as the planet and its magnificent ring system nod majestically over the course of its 29-year journey around the sun. These Hubble telescope images, captured from 1996 to 2000, show Saturn's rings open up from just past edge-on to nearly fully open as it moves around the sun.

Cuzzi believes that observations like these, while not currently understood, eventually will provide insights into the processes by which Saturn's ring structure was formed and continues to evolve. He noted that the Cassini spacecraft, which recently passed Jupiter en route to a four-year tour of the Saturn system starting in July 2004, carries several instruments that will provide much finer detail and greatly improve the ability to identify these non-icy constituents in the rings and the structure of the particles. The Cassini mission also includes

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Ames Aerospace Encounter to host employee day

On Thursday, June 28, from 10 a.m. until 2 p.m., the Ames Aerospace Encounter (AAE) will be holding another in its series of "Ames Employee Days at the AAE." The Encounter is located on the 2nd floor of Bldg. 226.

All on-site personnel are invited to attend, and bring their family and friends for a self- paced tour. The tour will take about an hour.

The Encounter is a unique, interactive educational program designed for 4th, 5th and 6th grade students. It stirs young people's imagination and fuels their enthusiasm for science, mathematics and technology.

The Encounter is managed by the education group of the Office of Development and Communication, Code DX.

The Encounter is booked year 'round with 4th to 6th grade student field trips.

Children must be accompanied by an adult at all times. Employees are responsible for arranging to bring their guests on to Moffett Field.

For more information about this event, email: encounter@mail.arc.nasa.gov or call ext. 4-1110.

The last Ames Employee Day at the Encounter for the year will be held on Tuesday, July 31, from 10 a.m. until 2 p.m.

BY EDITH BARR

EOPO Updates

Excellence and Diversity

The Equal Opportunity Programs Office (EOPO) has undergone a number of changes in staff and office space, and is trying some new approaches to fulfill its mission. The mission of the EOPO is to promote and advocate equal opportunities for underrepresented groups at Ames, and to increase access to Ames-related research and careers for all Americans. The EOPO staff is working to accomplish this goal through recruitment, career advancement, complaint resolution and advocacy of Center support to minority institutions. A primary objective of the EOPO is to develop and maintain a diverse workforce.

One of the EOPO's new approaches is this monthly column that will highlight activities, provide information and, hopefully, facilitate a greater awareness of issues related to the promotion of a diverse workforce and equal opportunity (EO) programs such as the Minority University Research and Education Program (MUREP). Many of you may have seen the June 11 edition, which included a brief article and a picture of the MUREP NASA scholar students. The NASA scholars program is just one of many Ames EO initiatives that will be highlighted in this column.

In highlighting diversity, it is important to clarify what a diverse workforce means. First and foremost, the NASA Equal Opportunity and Civil Rights Policy Statement indicates that it is NASA policy that equal opportunity and civil rights be afforded to all employees and applicants for employment, regardless of age, religion, color, sex, national origin, age or disability. The statement further elaborates that NASA will institutionalize equal opportunity, equity and diversity in all that we do. Women, minorities and individuals with disabilities will be integrated into all occupational groups, grade levels and organizational units; will hold significant project, program, and senior management positions; and will be in the pool of outstanding talent from which candidates are selected. The goal of these efforts is to ensure a workforce reflective of our society at large, thereby making our agency and our nation stronger.

Beyond the requirements of EO law and regulations, NASA Administrator Daniel Goldin has issued a statement on the valuing of NASA personnel, which helps to further define the meaning of a diverse workforce. Specifically, he states that "It is not enough to simply develop a diverse workforce, we must also strive to treat all our employees with respect and dignity. I am calling upon all NASA managers to make it their personal commitment to provide a work environment, which gives all employees the opportunity to excel, regardless of their race, color, age, sex, national origin, religion, disability or sexual orientation. The achievement of a diverse work environment that is free of discrimination and sexual harassment is an integral component of NASA's mission."

In the spirit of Administrator Goldin's statements, the EOPO takes this opportunity to acknowledge June as National Gay, Lesbian, Bisexual and Transgender Pride month. A number of events are taking place throughout the federal workplace in recognition of PRIDE month. For more information about these events, please go to: www.fedglobe.org.

VPP STAR Tip

"Hazard reporting is probably up, while at the same time, injuries may be coming down. There probably is a lot more attention being paid to working safer, picking up after ourselves (and others) and removing possible hazards. It will take a sustained, creative and positive safety program to make people think and act more carefully."

…VPP Lessons Learned 1999, Johnson Space Center

Ames dependent is awarded NASA scholarship

NASA has a fund that was established to award scholarships agency-wide to qualified dependents of NASA and former NASA employees. This year there are six winners, including Saini Swati, daughter of Ames employee Subhash Swati.

Swati graduates this month from West High School in Tracy. She received straight 'As' in high school, including five advanced placement math and science classes. She ranked first in her class of 384 students, and scored 1,290 on her Scholastic Aptitude Test (SAT). Swati has earned numerous academic honors, including being the 'top math and science student' in the academic talent development program. She was also recognized for her independent research project on the performance benchmarking of computing systems.

Swati was president of her school's canned food drive, toy drive club and Easter egg hunt for disadvantaged children. Outside of school, she volunteers at a convalescent home, a homeless shelter and the public library, among other things. She plans to major in computer engineering and computer science in her college endeavors.

The NASA scholarship program came into being as a direct result of a substantial unsolicited gift from the noted Pulitzer Prize winning author, James A. Michener. In addition, many NASA employees have contributed to the fund directly or through the Combined Federal Campaign. Other major contributors include the Freedom Forum (to honor the Challenger crew in 1994, and again in 1997 to honor Shannon Lucid) and the JSC and KSC chapters of the NASA Alumni League. This year, the Scholarship Fund will be included in all Combined Federal Campaigns (CFCs) as a National Unaffiliated Agency (identification number 1038).

Other winners this year include Linda Hung, Sarah H. Zaman and Christopher R. Malow, all dependents of Glenn Research Center employees; Bobbie G. Chern, whose father works at Goddard Space Flight Center; Nicholas A. Singhal, from Johnson Space Center; and Jyothi M. Natarajan from Langley. This brings the total number of recipients to 97, of which 61 have graduated to date.

NASA and America can be proud of these young people. All had high grade point averages; all scored well on their SATs; and all were actively involved in their communities. The final selection process was very difficult. Award recipients have been mailed their $8,000 scholarship contracts, and a personal letter will soon be mailed to each of the other applicants.

The board of directors of the NASA College Scholarship Fund, Inc., has determined that six scholarships will be awarded next year. Each scholarship will be renewable annually for a maximum of $8,000 over a six-calendar-year period.

Supplier diversity seminar held

photo by Jonas Diño

Reginald Williams, of Procurement Resources, Inc., presented a seminar on "Effective Strategies in Supplier Diversity" June 6 at the NAS auditorium.

Williams approached an old problem with new and exciting ideas for a proactive approach to supplier diversity--targeting opportunity. His opinion is that NASA's growth is tied to the growth of its tax-paying constituency. Small business minority and women- owned enterprises represent the fastest growing segment of that tax base. NASA is committed to a proactive posture to ensure participation of these critically important groups. Williams gave his audience the tools to support those goals.

Reginald Williams, of Procurement Resources, Inc., shown here presenting his "Effective Strategies in Supplier Diversity" seminar at Ames on June 6.

Is family safety Important? It's magical!

One family member dies every 20 minutes, in the United States alone. Thirteen family members incur a disabling injury every single minute.

You cannot protect your kids forever. Wouldn't it be wonderful if they thought about the safe thing to do before they find themselves in trouble? Bring them to the Ames Family Safety Magic Show and they would remember.

Magic Mike has a very special gift with his ability to communicate with children of all ages. He will make sure that everyone knows just how important safety is! The magic show is scheduled for July 11 in the main auditorium, N-201 at 11:00 a.m. There will be snacks for the kids (and accompanying adults) starting at 10:00 a.m. at the building entrance.

Adults with children will be permitted to bring their kids through the main gate simply by presenting a photo ID of themselves. The accompanying kids can come incognito.

Ames' Futureflight Central may save LAX millions

"Three minutes!. . . . two minutes!" announced Marlene Hooten of Code IC, as she counted down to another 'run' of tests of a virtual Los Angeles International Airport (LAX) at Ames' FutureFlight Central (FFC) air traffic control tower simulator in Bldg. N-262. Hooten is one member of a large number of people who recently conducted the LAX simulation sessions in Ames' one-of-a-kind facility.

Interior panoramic view of Ames' FutureFlight Central air traffic control tower simulator in Bldg. N-262.

After stepping into a synthetic world created by computer power and much other human work, the large research team, which also included pilots and air traffic controllers, may have saved millions of dollars by creating and testing several versions of a virtual, modified Los Angeles International Airport. The team's main goal was to test ways of reducing 'runway incursions.'

A runway incursion is any occurrence at an airport involving an aircraft, vehicle, person or object that creates a potential collision hazard with an aircraft during take-off or landing. FutureFlight Central is a two-story simulator. The second floor is surrounded by rear projection screens that look like the air traffic controllers' observation windows inside their control tower.

On the main floor, pilots sit in a room with partitioned sections. Each pilot stares at computer screens. These "pseudo pilots" each control from one to a dozen computerized aircraft. A sign outside their room reads, "Warning -- Do not enter. Test in progress."

"The research partners were surprised that some changes in airport operations that they thought would work just weren't practical when air traffic controllers and pilots tried them in the artificial airport," said Ames simulation project manager Boris Rabin. "Millions, maybe billions of dollars might have been wasted if one of the less effective changes had been implemented without testing first in FutureFlight Central," he said. Researchers also found that some potential solutions to reduce runway incursions worked well during full simulations of LAX. Final results of the LAX simulations will not be available for several months -- after extensive analysis, according to researchers.

The FFC simulator creates a 'virtual' airport in order to let planners test airport designs and changes. The simulator is a walk-in, full-scale, 360-degree facility that portrays runways, landings, ground traffic and many other airport factors in a realistic, computerized world. During simulations, scenes evolve in the same manner that real-world changes occur. In the computer world, airplanes come and go and the weather changes. Consoles at each controller location show radar, weather maps and runway lights. They also have touch-screen controls and other data readouts. The FutureFlight Central simulator control tower floor is slightly bigger in diameter than the LAX tower level where controllers observe airplane movement from a high vantagepoint.

"We are looking at adding a by-pass taxiway on the west side of the south runway complex," said Raymond Jack, a chief of operations at LAX. "It (the runway by-pass) possibly relieves our runway incursion problem areas. The reason we are doing these simulations is we want to look at all the possible outcomes and impacts from these possible changes," he explained.

Jack observed the air traffic controllers during simulations, listening on headsets and taking notes. He and other airport officials observed, and sometimes pointed to the imaginary airplanes landing in the LAX computer world.

A wide range of people including Federal Aviation Administration (FAA) LAX-based air traffic controllers; pilots from United Airlines and other carriers; Los Angeles World Airports (LAWA) officials; and NASA researchers were involved in the LAX simulations to analyze the "what-if" simulations.

In the virtual LAX airport simulation, researchers tried different options using a runway by-pass that would enable airplanes to travel between the north and south runways. Using a by-pass taxiway on the west side of the airport, instead of directing airplanes to cross in the middle of busy runways in periods between take-offs and landings of other aircraft, could significantly reduce the chance of incursions, according to Rabin. Another scenario that was purely procedural was discarded because it didn't help, according to one observer.

"Changes could possibly increase controller workload," said Jack. "And that's why we're (trying them) in a virtual environment. Before we invest millions and millions of dollars, we can look at data rather than making assumptions based on two-dimensional computer models and engineering assumptions," he continued.

On the second floor of the air traffic control simulator five controllers immersed themselves in the virtual world, their rapid-fire controller jargon machine-gunning words in a low hum as they spoke into their headset microphones. Bits and pieces of quick "controller speak" seemed to pop up in the air. "American 222," said one controller rapidly, and the rest of the communication seemed to fade into the darkened tower.

Computer images of planes landing, and taking off, and moving along taxiways appeared on the scene as the computerized vision of LAX got busier. "Taxi to the gate," another bit of a controller's communication could be heard.

One controller quickly paced across the middle of the tower floor, his long headset cord stretching about 10 meters (30 feet) across the area. From his post, he carried a small strip of paper, a flight plan, to a controller across the circular tower. "Turn the corner and pull short..." another controller said, and his talk was too rapid for the casual observer to completely follow.

"We are doing multiple simulation runs,"

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Ames' Futureflight Central may save LAX millions

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said Rabin. "We do one change per alternative, just as in a scientific experiment where you change one variable at a time to see what the impact of the change is. This procedure leads us to more certainty when we analyze the simulations," Rabin explained.

Rabin used a small video camera to tape the controllers as they worked. "I can't hold them there any more," said one controller. "Just maintain 2,000. That's correct," said another. "United 732..."

Putting a by-pass taxiway at LAX will take the pressure off one of the controllers, "Ground One," who handles ground traffic of airplanes, according to LAX controller James McMahon. "We are trying to figure out if there is a better way to alleviate the pressure on Ground One," McMahon continued.

A by-pass taxiway at LAX could result in some pilots not understanding how to use the new ground 'alpha route' that would follow the taxiway, according to LAX controller Barry Gloth. "Two out of three pilots won't know what the alpha route is," he said.

The LAX study, now in "Phase II," is the first investigation done at FutureFlight Central during which air traffic controllers and pilots performed their jobs in a simulation to try major changes to LAX before they are actually implemented at the real airport.

"I think it's a very good 360-degree simulator," said Ronnie Uhlenhaker, FAA program manager for the southwest region of the United States. Perhaps the FAA would do "what-if" scenario tests of the Dallas-Ft.Worth, TX, airport, to test how long planes take to taxi from one location to another. Researchers could also test potential alternative taxiways, he said.

United Airlines pilot Steve Steiner said the simulator works pretty well. However, you need to be ready to input aircraft commands quickly to make sure they happen as fast as in the real situation, he added.

During simulations, researchers measured airport take-off and landing capacity, including runway occupancy time, inbound and outbound taxi times, hold times, and arrival and departure rates. In addition, researchers measured controller-pilot communications, controller workload, delays and other factors. These data, along with video and audio recordings, will allow the project team to assess the impacts of possible new runway procedures and construction on ground traffic flow and airport capacity.

Later, during Phase III, an industry group guiding the project, including Ames researchers, will link a 747 airplane simulator at the Crew Vehicle Systems Research Facility with the FutureFlight Central simulator to study the 'human factors' component of runway safety. These studies involve examination of pilots and controllers and their interactions with the airport environment. The goal of human factors studies is to better understand human-machine interaction, thereby increasing efficiency and promoting human well being.

More FutureFlight information is on the Internet at: http://ffc.arc.nasa.gov

BY JOHN BLUCK

Indiana students at Ames

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tems adapted to new environments, how visual perception changes in space and experienced a working fundamental biology laboratory. On June 14, they visited Ames' flight simulators and learned about remote-sensing technology. Activities on June 15 focused on astrobiology, wind tunnels and nanotechnology.

The students also spent a day scuba diving in Monterey Bay, experiencing for themselves one of Earth's "unique environments." Huckleberry noted that achieving their open-water dive certification helped the students better understand differences between Earth's gravity and the microgravity of space.

"A primary goal of this project was to reach other students with the message that all students, regardless of any self-thought, physical or socially-perceived limitations, can learn," said McClain. "By using space biology as a motivational tool, boundaries can be erased and high aspirations can be set and achieved."

BY ANN HUTCHISON

First education chief retires

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ships with state science education supervisors in this region and expanded NASA's commitment as these states invigorate their education systems.

Utah's State Science Education Supervisor, Brett Moulding, said that Hull is always willing to become involved in Utah's science education issues and "bring the larger scale of NASA education to bear on our situation. He has been very conscientious in addressing our needs."

Hull and his wife Marian plan to stay in the area and make frequent trips to visit children and grandchildren in the midwest.

BY TOM CLAUSEN

Errata

On page 3 of the June 11 issue of the Astrogram, the picture accompanying the safety article included a caption which incorrectly identified the woman in the photograph as Karen Gentry. It should have identified her as Jill Dunbar of the NASA Advanced Supercomputing (NAS) Division. We apologize for the error.

Saturn's tilted rings reveal color variations

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an atmospheric entry probe into the organic smog-shrouded moon Titan, which might have lakes or seas of liquid ethane on its frigid surface.

Cuzzi's collaborators include Drs. R. French of Wellesley College, L. Dones of Southwest Research Institute, Mark Showalter of Stanford University (and formerly of Ames) and Paul Estrada of Cornell University.

The Space Telescope Science Institute (STScI) also issued a news release on the data, "A Change of Seasons On Saturn." It can be accessed, together with electronic images, animation and additional information, at: http://oposite.stsci.edu/pubinfo/pr/2001/15

NASA's Hubble Space Telescope is a project of international cooperation between NASA and the European Space Agency (ESA).

BY KATHLEEN BURTON

Center Briefs

NASA awards agreements to strengthen research capabilities

NASA competitively selected 35 meritorious, peer-reviewed research proposals under the Experimental Program to Stimulate Competitive Research, or EPSCoR. The 3-year performance-based awards cover 19 states at a total cost of $6.6 million, subject to appropriation in future years.

What makes the EPSCoR program unique is its goal to target states of modest research infrastructure. EPSCoR provides funding to assist states in developing a more competitive research base within their selected academic institutions.

Star factory near galactic center bathed in high-energy X-rays

Near the crowded core of the Milky Way galaxy, where stars are so plentiful and shine so brightly that planets there would never experience nighttime, astronomers have found a new phenomenon: a cauldron of 60-million degree gas enveloping a cluster of young stars.

Professor Farhad Zadeh of Northwestern University, Evanston, IL and his collaborators used NASA's Chandra X-ray Observatory to trace the gas around the Arches cluster, a well-studied region of star formation that is home to some of our galaxy's largest and youngest stars.

"This is the first time we have seen a young cluster of stars surrounded by such a halo of high-energy X-rays," said Zadeh in a news conference at the American Astronomical Society in Pasadena, CA. "This supports theoretical predictions that stellar winds from massive stars can collide with each other and generate very hot gas."

Pattern in black hole and neutron start eruptions discovered

In the fiery machinery of the night sky, where neutron stars and black holes wrapped in binary systems can flare and burst randomly, astronomers have uncovered a predictable mathematical pattern in the X-ray light emitted over time.

Drs. Patricia Boyd and Alan Smale of NASA's Goddard Space Flight Center in Greenbelt, MD, have followed the history of X-ray emission from three binary star systems over the last several years and uncovered a unifying concept: The number of days between the low points of emission in each binary system is random yet always based on multiples of a single constant number.

The scientists say this never-before-seen pattern reflects the physics of how matter swirls about and finally pours onto a neutron star, a star composed of nuclear matter that has collapsed under its own gravity, or into a black hole.

New facility to improve airborne telescope's clarity

A NASA airborne observatory's images of space will be sharper and more precise, thanks to a newly installed mirror coating facility at Ames.

Constructed of stainless steel, the mirror coating facility resembles a huge pressure cooker. It measures approximately 4.3 meters (14 feet) in diameter, stands about 4.9 meters (16 feet) high and weighs 10 metric tons (22,000 pounds). Scientists will use it periodically to recoat the 2.7-meter (106.3-inch) diameter telescope's primary mirror in NASA's Stratospheric Observatory For Infrared Astronomy (SOFIA). Installation of the new coating facility in the SOFIA Science and Mission Operations Center at Ames will take several weeks. The coating facility supplier is Chart, Inc., Westborough, MA.

Image courtesy USRA

Newly installed stainless steel SOFIA mirror coating facility at Ames.

"We're very pleased that this critical, unique element of SOFIA's ground support system has arrived here at Ames," said SOFIA Project Manager Chris Wiltsee. "This facility will play a major role in the future missions of SOFIA."

Scientists require that SOFIA's sophisticated telescope be kept immaculately clean in order to ensure accurate astronomical observations.

"Once a year, we will use the mirror coating facility to replace the high-precision coating on the telescope's mirror," explained Eric Becklin, chief scientist with Universities Space Research Association (USRA), NASA's prime contractor for the SOFIA project. As needed, the top of the stainless steel vacuum chamber will be lifted off and SOFIA's mirror will be lowered into the chamber, where it will receive a delicate coating of aluminum that is about one 300th the thickness of a human hair. The total amount of aluminum that will coat the 60-square foot mirror surface is roughly equivalent to the quantity of aluminum that may be found in about one-fourth of an average soda can.

The coating process involves vaporizing aluminum. Inside the facility's chamber is a filament array system containing more than 60 tungsten filaments. These are similar to the filaments inside many light bulbs, but much larger, and are connected to a high-current, low-voltage power supply. Before beginning the coating process, the old coating on the mirror is chemically stripped away and the bare glass is thoroughly cleaned. A worker enters the chamber and hangs several strips of very pure aluminum on each filament.

The mirror assembly is then lowered into the chamber and everything but the mirror's front surface is shielded with special materials. After the top is reinstalled, powerful pumps remove air from the chamber to create a near vacuum. Next, the filaments are electrified, and the resulting heat generated within them vaporizes the aluminum. The vaporized aluminum then adheres to the unshielded mirror's surface,

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Indiana students study sciences at Ames

Deaf students and their hearing counterparts from two Indiana high schools recently took part in a hands-on science and technology learning experience at Ames.

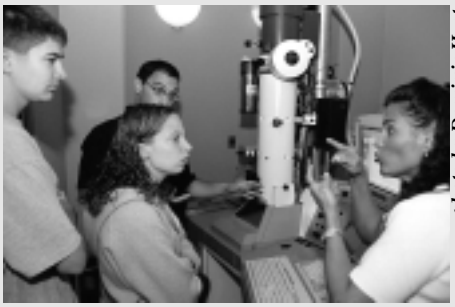

photo by Dominic Hart

Students Drew Robarge (left) and Laura Sutton (center) learn about an electron microscope from Joseph Varelas (dark shirt) as part of their visit to Ames' Center for Bioinformatics. American sign language interpreter Jeannie Clark is at right.

The group included six students from the Indiana School for the Deaf (ISD) in Indianapolis and six from the Indian Creek High School in Trafalgar, IN. The students, three teachers and two American sign language interpreters visited Ames as part of an annual experiential field trip that uses the study of space as a motivational learning tool. An anonymous benefactor provided funding for the trip. Dr. Joan Vernikos, former chief of the Life Sciences Division at Ames and recently retired head of life sciences at NASA Headquarters, serves as a consultant to the project.

"These unique, hands-on field trips bring exciting, relevant space exploration learning experiences to students in Indiana," said Bonnie McClain, NASA's life sciences outreach projects manager. "These experiences also allow students to relate science concepts learned in the classroom to real-world applications."

"We want to demonstrate that science can be a common bond that unites students in learning, and transcends all boundaries and barriers," said ISD science teacher Teresa Huckleberry.

photo by Jonas Diño

Visiting students spent a day scuba diving in Monterey Bay, experiencing for themselves one of Earth's "unique environments." Achieving their open-water dive certification helped the students better understand differences between Earth's gravity and the microgravity of space.

The Indian Creek High School students, led by science teacher Carol Piety, have been studying American sign language so they can communicate with the deaf students. The two groups also have participated in several joint science projects.

The theme of this year's field trip was "Adapting to Unique Environments." Activities at Ames highlighted the role of sensory systems such as sight, hearing and touch, and the use of technology, in helping humans adapt to unique environments such as space. Students and their teachers learned first-hand how NASA research into the fundamental processes of the sensory system help scientists understand how the human body perceives and adapts to different environments, and why this is important to space exploration.

Ames scientists also helped the students realize how technology can be used to "extend" the senses. NASA research in advanced technologies is finding applications in remote sensing, accurate communication of information in varied forms to multiple locations, and the direction of medical procedures from locations far from the patient.

"Deaf students depend on technology to open windows of knowledge and networks of communication for them that would not be possible otherwise," Huckleberry said. " All the students learned about how technology can increase the ability to erase boundaries of physical limitations and provide ways to express emotions in new ways." Technology also can transcend the boundaries of a "culturally normal" way of thinking and open minds to new viewpoints, added Piety.

Student activities on June 11 and 12 focused on space life sciences at Ames. Students learned about how sensory sys-

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Plane pull and free flights for kids provide fun for all

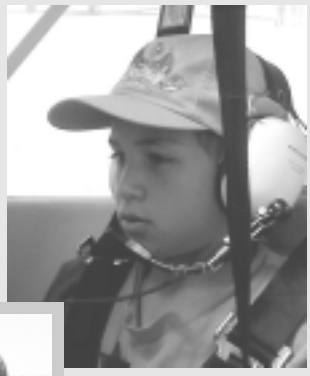
On June 16, Moffett hosted the third annual airplane pull with over 4,000 participants, divided into 23 member teams, present at this charity event.

Teams attempted to pull a United Airlines Boeing 727 a distance of 12 feet in the shortest amount of time. Proceeds from the airplane pull benefit the Special Olympics in Santa Clara County. This weekend's event raised $22,000 for Special Olympics.

The Experimental Aircraft Associations (EAA) Aviation Foundation's Young Eagles organization provided free flights for kids ages 8 to 17. Private pilots brought their privately-owned aircraft to take up eager kids and fly them over the Bay Area.

The EAA's hope is to educate young people about aircraft and help them discover career opportunities in aviation.

For more information about Young Eagles' upcoming events, visit the local web site at: www.eaa62.org.



Henry Terlep at the EAA event at Moffett on June 16, about to take off in one of the aircraft, thereby becoming a "young eagle."

Two of 50 or so classic cars on display at the plane pull event on June 16.

photos by Astrid Terlep

A United Airlines Boeing 727 being pulled by one of the plane pull teams.

Ames' first education chief retires

For 40 years, Garth Hull of the Education Office, Code DXE, has been introducing teachers and students throughout the west to NASA projects and programs and opening the door for them to be involved with NASA. Hull has initiated education partnerships; expanded the network of NASA Educator Resource Centers to locations in every western state; developed innovative teacher workshop programs; and traveled extensively, visiting schools and taking NASA's mission to the far reaches of the west. In the last decade, he has been especially effective in systemic education reform efforts in every western state, managing NASA's Aerospace Education Services program and working with school administrators in state education offices.

Before coming to NASA, Hull graduated from Augustana College in Rock Island, IL and received his masters in education degree from MacAlister College in St. Paul, MN. He was drafted into the Army in 1955. After two years at Ft. Carson, CO, he taught junior high school science and math in Manitowoc, WI and became involved in the science and math education movement that swelled after Sputnik was launched. After two years of classroom teaching, Hull joined the faculty of Michigan State University where he developed and gave presentations in science and math at schools throughout southern Minnesota, northern Iowa, and western Wisconsin.

In January 1962, Hull spent a week at NASA Headquarters to kick off the first NASA education program. He became one of eight teachers selected to be the first NASA educators. Their duty was to travel to schools across the country--Hull was assigned to California--and their task was to take lively science lecture demonstrations and the latest NASA data out to schools.

The first NASA education program in California that he presented was on the very day that John Glenn became the first American to orbit the Earth, Feb. 20, 1962. As NASA sent more astronauts into space in the Gemini and Apollo programs, Hull made arrangements for teachers to participate. During Apollo 16 and 17 and for Skylab and Apollo-Soyuz, his 'Classroom in the Sky' program placed teachers in chartered jetliners to cross the country on specially-designed routes to see key geologic features of Earth from the air and learn about them from Ames researchers. Each trip culminated in briefings at Kennedy Space Center by the launch team and Werner Von Braun himself, and then watching the Saturn V liftoff.

photo by Tom Trower

Garth Hull

In the '70s, Hull developed education programs to take advantage of the Pioneer Project, bringing teachers to Ames for significant project milestones and to meet Ames researchers and managers. He also introduced thousands of teachers to NASA by hosting educator conferences in concert with launches at Vandenberg AFB in Lompoc and with Shuttle landings at Dryden Flight Research Center.

"Teachers are hungry for new knowledge," Hull says, " and the people of Ames have always been responsive to this opportunity, down through the years. NASA's message of exploration is valued highly by teachers and in programs that bring researchers and teachers together; there was always good rapport."

For the last few years, Hull has served as Ames pre-college education programs officer, delivering NASA's education programs and services to students and teachers in the 11 state western region and directing a cadre of university educators (aerospace education specialists) to schools throughout the region. Hull has developed relation-

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SAFETY SNAPSHOTS

This feature is one in a series intended to inform the Ames community about facets of Ames' safety and health programs.

Job Hazard Analysis

PROFILE

Did you know that there were 53 work-related injuries and illnesses of civil service and contractor employees at Ames in FY00? Even with the Center's increased emphasis on the active implementation of safety principles in the workplace and the increased efforts of our workforce, accidents can still occur. We need to be as sensitive as reasonably possible to how we are doing our job, controlling all hazards and changing our behavior whenever it might threaten the safety of our operations.

The key is to identify what can cause an injury and then design ways to best manage any hazards. This will go a long way to achieve our safety goal: ZERO INJURIES. One way to increase our awareness of workplace hazards is to do a Job Hazard Analysis (JHA) of all tasks. Job hazard analysis is a process that integrates safety and health principles into the performance of the task. When doing a JHA, each step of a task is examined to identify potential hazards and then a procedure is written that describes the dangers involved and the safest way to do the job.

Based on input from a recent audit by NASA Headquarters personnel, Ames is focusing more attention on job hazard analysis (JHA). What are the benefits of doing a JHA? While identifying potential hazards in a particular task or operation, other interesting ideas may come to light that might improve the process, such as additional training, improvements to the equipment or time-saving additional equipment. The JHA process allows supervisors and employees to identify potential concerns in their environment, and thereby prevent mishaps by their control of the hazard. When employees are actively involved in improving job safety, the awareness of hazards is increased and smart work procedures are established. The result is creation of a more sensitive and productive work environment. Is there a JHA that applies to your job? Ask your manager about where the JHA's for your job are posted?

Many JHA's have already been documented and can be viewed on-line at: http://vpp/. Employees and managers are welcome to use these as they are or modify them to meet specific needs. A blank JHA form is available on-line as well. Michael Hulet, Ames Occupational Safety manager, can answer questions and provide assistance with JHA. He can be reached at ext. 4-0268.

Event Calendar

Model HO/HOn3 Railroad Train Club at Moffett Field invites train buffs to visit & join the club in Bldg. 126, across from the south end of Hangar One. Work nights are usually on Friday nights from 7:30 p.m. to 9:30 p.m. Play time is Sunday from 2 p.m. to 4 p.m. For more info, call John Donovan (408) 735-4954 (W) or (408) 281-2899 (H).

Jetstream Toastmasters, Mondays, 12 noon to 1 p.m., N-269/Rm. 179. Guests welcome. POC: Samson Cheung at ext. 4-2875 or Lich Tran at ext. 4-5997.

Ames Ballroom Dance Club, Tuesdays: Paso Doble 6/26. 3 levels of classes, from Beg. to Int., 5:15 - 6:45pm. Classes in Building 944, the Recreation Center. Women dancers encouraged to join. POC: Helen Hwang, hwang@dm1.arc.nasa.gov.

Ames Bowling League, winter league from September through April on Tuesdays, at 6 p.m. at Palo Alto Bowl. Bowlers needed. POC: Mike Liu at ext. 4-1132.

Ames Diabetics (AAD), meet twice a month on first & third Wednesdays, 12 noon to 1 p.m., in the Ames cafeteria, Mega Bites, far corner of Sun room. Peer support group that discusses news that affects diabetics, both type I & II & exchange experiences in treatment & control & help each other best cope with the disease. POC: Bob Mohlenhoff, ext. 4-2523, or email at: bmohlenhoff@mail.arc.nasa.gov.

Ames Child Care Center Board of Directors Mtg, Every other Thursday (check website for meeting dates: http://accc.arc.nasa.gov), 12 noon to 2 p.m., N269, rm. 201. POC: Katharine Lee, ext 4-5051.

Native American Advisory Committee mtg, Jun 26, 12 noon to 1 p.m., Building 19, room 1096. POC: Mike Liu at ext. 4-1132.

Environmental, Health and Safety Monthly Information Forum, Jul 5, 8:30 a.m. to 9:30 a.m., Bldg. 19/Rm 1040. POC: Julie Quanz at ext. 4-6810.

Nat'l Association of Retired Federal Employees, (NARFE), San Jose Chapter #50, Mtg, July 6, 11 a.m., at THREE FLAMES Restaurant, 1547 Meridian Ave. (near Hamilton) San Jose: All NARFE Members, Retirees, Fed. Employees, Families and Guests. $16 per person, RSVP by 6/30 to Mrs. Perry, (650) 967-9418. For membership INFO. call NARFE at 1-800-627-3394.

Ames Contractor Council Mtg, July 11, 11 a.m., N-200, Comm. Rm. POC: Paul Chaplin at ext. 4-3262.

NFFE Local 997 Union General Mtg, Jul 18, noon to 1 p.m., Bldg. 19/Rm. 2017. Guests welcome. POC: Marianne Mosher at ext. 4-4055.

Ames Amateur Radio Club, Jul 19, 12 noon, T28-N (across from N-255). POC: Michael Wright, KG6BFK, at ext. 4-6262. URL: http://hamradio.arc.nasa.gov

Ames Classifieds

Ads for the next issue should be sent to *astrogram@mail.arc.nasa.gov* by the Monday following publication of the present issue and must be resubmitted for each issue. Ads must involve personal needs or items; (no commercial/third-party ads) and will run on space-available basis only. First-time ads are given priority. Ads must include home phone numbers; Ames extensions and email addresses will be accepted for carpool and lost & found ads only. Due to the volume of material received, we are unable to verify the accuracy of the statements made in the ads.

Housing

3 bd/1.5 ba, 2-story twnhs on Luz Avenue, San José. Freshly painted inside, dishwasher, gas heat, w/w carpet, outside child play area/large patio. 1 car port. Easy access to H101/680/280. $295K. Azucena (408) 559-2881.

For rent: 10 minutes from Santa Cruz. Unfurnished room in house. Felton area off Highway 9. Kitchen privlidges, yard, quiet neighborhood. $525/mo includes ultilities. Karen (831) 335-1301, lv msg.

Room in new house w/ new appliances, AC; N/S/P; clean and quiet; $700; in San José close to all freeways & downtown. Call (408) 281-4765 or email at: badrom2@yahoo.com

3bd/2ba, 2-car ga twnhouse in N. Fremont for rent. New carpet, new paint and gardener. Avail. Mid July, $1,950/mo. Call (510) 471-2570.

Mountain View Gemello Park District 3/1 home for rent. Remodeled with new kitchen, washer/dryer, carpets, doors and roof. Quiet neigborhood in Los Altos school district. $3,300/mo. Call (650) 493-1211.

3 bd/2 ba, 1700 sq.ft. Yr. 2000 Mnfctrd. home right off of Shoreline (5 min commute or 15 min walk). Grmt. fully frnshd. ktchn. w/bay wndws. Mrbl.frplc. Huge mstr. bd. and bthrm w/jczz. Cntrl A/C and heating. Lots of amenities. $185K. James (650) 428-0123.

Master bdrm available for N/S prof. Sunny, 2 master bdrm/2 bath end-unit condo (Sunnyvale) with gar, W/D, lrge rooms, storage, central air, low utilities, jac/pool, balcony, 3 mls from Ames, avail late July/early August, $900 plus 1/2 util's. Alan (408) 830-0755.

Miscellaneous

Free to good home: beautiful 8 yr old neutered male cat; extremely affectionate & mellow; great grandma's companion (but mine turned out to be allergic!). Call (408) 295-3968.

Mens brown leather jacket, X/L, $70 or B/O. Deanna (408) 260-1180, between 5 to 9 p.m.

Horse, "Bo" Jingle, registered Mountain Pleasure Horse, smooth gaited, real cute gelding, 13 yrs, 14.3H, good health, excellent ground manners, best for experienced rider, $3,500 or B/O. Call (408) 773-1236.

49er tickets (pair). Section 53 UR. Pre-season, Sat 8/25, 6 p.m. Seattle $80/pair. Regular season, Sun 10/7 5:30 p.m. Carolina $110/pair. Call (510) 656-7654.

Rear fenders for 73-74 VW Super Beetle, $60 or B/O. Deanna (408) 260-1180, between 5 to 9 p.m.

Artist-designed Aquarium 100 gal aqua w/ waterfall, brook, terrarium, plants, fogger in gorgeous solid light wood cabinet. 3 y/o, $950 (orig $3600). Steve/Tammy (408) 366-0826.

Electronic self-cleaning cat litter box in excellent condition. Let the "Litter Maid" handle that messy chore. Includes free bonus: Huge bag of premium cat food. $60. Call (408) 257-3175.

Yamaha DX-7 synthesizer, good condition, with 2 ROM cards and shipping case. Asking $200 or will consider best offer. Call (415) 334-8322, evenings.

Beautiful (happy) live aquarium with large freshwater Ryokans plus other aquarium equipment/accessories, $230 or B/O; Very nice 4'x6' glass dining or office table, $90 or B/O. Call (408) 296-8182.

Looking for a badge-a-minit, semi-automatic machine, in gd cond. Email: falcon7777@earthlink.com

Transportation

'70 VW convertible classic, original owner, no smog needed; transmission ok; needs work on top & possibly engine. $1,600. Esther or Art (650) 961-2732.

'91 Ford Probe, 85K mls, 5-spd manual trans, blue. Cruise, pwr steering, am/fm cass. Runs great. New brakes. No problems passing smog. Orig owner. $1,900. Joe (408) 247-1125 or olejnic@yahoo.com.

'91 Lexus LS-400; burgundy inside/out, leather, all power, V-8, no accidents, 2nd owner, all records/paper work, great condition, tape deck, sun roof, $8,750/ obo. (408) 772-4060 / (831) 688-8754 ask for Damien or e-mail: dcanerot@mail.arc.nasa.gov "

'93 GMC Yukon (black), Good condition, $10,500. David (408) 272-2310.

'93 Subaru Legacy wagon, white, 4WD, 5 spd. AC, 87K mls, mint cond., $4,800. Call (650) 574-7414.

'94 Infiniti J30, excellent condition, low consumption. $9K or B/O. Call (408) 733-1906.

'97 Mercury Grand Marquess, xlnt. cond., 15K miles, white w/grey leather interior, 4-dr, loaded, best offer over $15K. Call (650) 917-1716.

'98 Honda Civic LX 4dr sedan, silver, 36K mls, $13,500, runs great, call for appointment to view (408) 732-4180 or email lcontreras@mail.arc.nasa.gov.

Wanted: fiberglass Dune Buggy on VW chassis, any condition considered from project to nice runner. Also any buggy parts, VW beetle performance parts, or old buggy magazines/literature. Call (408) 225-8396.

Lost & Found

Moffett Field Lost and Found may be reached at ext. 4-5416 at any time. Residents and employees at Ames may also use Internet browser at: http://ccf.arc.nasa.gov/codejp/pages/lostFound.html to view a list of found property and obtain specific instructions for reporting lost or found property and how to recover found property. Call Moffett Field security police investigations section at ext. 4-1359 or email at: mfine@mail.arc.nasa.gov.

Found. ATM debit card at Ames Mega Bites cafeteria on 6/8. Laura ext. 4-2162 to describe and claim.

Ames public radio

1700 KHz AM radio -- information announcements & emergency instructions, when appropriate, for Ames employees.

Exchange Information

Information about products, services and opportunities provided to the employee and contractor community by the Ames Exchange Council.

Beyond Galileo N-235 (8 a.m. to 2 p.m.) ext. 4-6873

Ask about NASA customized gifts for special occasions. Check centerwide emails for special sales and events.

Mega Bites (Ames Café) N-235 (6 a.m. to 2 p.m.) ext. 4-5969

Catering is available for your office B.B.Q. or luncheon. Come by for details.

Visitor Center Gift Shop N-223 (10 a.m. to 4:30 p.m.) ext. 4-5412

NASA logo merchandise, souvenirs, toys, gifts and educational items. Make your reservations for Chase Park here.

Tickets, etc... (N-235, 8 a.m. to 2 p.m.) ext. 4-6873

Oakland A's vs. Kansas City Royals, Sat. July 28, 1:05 p.m., Network Associates Coliseum. Field level seats only $9. Plus coupon for hot dog, chips and soda, only $3.25. Join for the fun. Tickets are limited, so get yours early.

NASA Lodge (N-19) 603-7100

Open 7 days a week, 7:00 a.m. to 10 p.m. Rates from $40 - $50.

NASA Swim Center (N108) 603-8025

The pool is open for the summer. Book your office birthday party. A fun way to spend the day.

Vacation Opportunities

Lake Tahoe Squaw Valley townhse, 3bd/2ba, balcony view, horseback riding, hiking, biking, golf, river rafting, tennis, ice skating and more. Summer rates. (650) 968-4155, DBMcKellar@aol.com

South Lake Tahoe cottage with wood fireplace and hot tub. Rates from $50 to $130 per night. Call (650) 967-7659 or (650) 704-7732.

Vacation rental, Bass Lake CA 14 mls south of Yosemite. 3 bd/1 1/2ba, TV, VCR, MW, fireplace, charcoal BBQ, private boat dock, great lake view. Sleeps 8. $1,050/week. Call (559) 642-3600 or (650) 390-9668.

New facility to improve airborne telescope's clarity

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thereby providing it with a thin aluminum coating. To minimize the build-up of dust on the mirror surface that could damage the coating or otherwise degrade scientific performance, specialists also will use pressurized carbon dioxide gas to clean the mirror inside the 747 once a week. A special wand-shaped nozzle will condense the gas into "snow" as it flows onto the mirror.

"Using the wand, the spray is directed across the surface of the mirror at a glancing angle," explained Patrick Waddell, USRA's associate director of the SOFIA Mission and Support Group. "The carbon dioxide snowflakes carry the dust away." Although this dramatically reduces the frequency of re-coating, the mirror will continue to degrade, according to Waddell. To further help keep it clean, workers periodically will also gently wash the telescope's mirror with a water-based liquid.

SOFIA's astronomical observations will be conducted at an altitude of about 41,000 feet aboard a modified Boeing 747SP aircraft operated and maintained by United Airlines. While using airborne telescopes is not new, SOFIA will be the world's largest and most powerful, considerably larger and more sophisticated than its predecessor, the Kuiper Airborne Observatory that was based at Ames from 1971 to 1995.

NASA awarded a $484.2 million contract to Universities Space Research Association, Columbia, MD, in December 1996, to acquire, develop and operate SOFIA. Other team members include Raytheon Aircraft Integration Systems, Waco, TX; United Airlines, San Francisco; the University of California, Los Angeles, Berkeley and Santa Cruz, CA; the Astronomical Society of the Pacific, San Francisco; the SETI Institute, Mountain View, CA; and Sterling Federal Systems, Redwood City, CA. SOFIA's complex telescope is being developed by DLR, the German Aerospace Center, located in Bonn. The specifications for the mirror coating facility were developed by NASA Ames with assistance from USRA and the University of California Observatories in Santa Cruz, CA.

Annual operating costs of SOFIA are anticipated to be about $40 million. SOFIA's first test flight is currently scheduled in October 2003 at Raytheon's Waco, TX, flight facility. SOFIA is scheduled to arrive at Ames in May 2004 for final testing preparatory to full-scale operations starting in late 2004. Further information about SOFIA is available on the SOFIA web site, located at: http://sofia.arc.nasa.gov

BY MICHAEL MEWHNNEY

Exchange to sponsor free lunch

The Ames Exchange has selected the date of Thursday, July 19, to provide a centerwide free lunch celebration.

This is an opportunity for the Exchange to thank all Ames employees for their support of the Mega Bites cafeteria, the gift shops and our other activities.

The luncheon will be held in the patio area next to the Mega Bites cafeteria. Multiple food sites will be provided to avoid long lines.

Astrogram deadlines

All Ames employees are invited to submit articles relating to Ames projects and activities for publication in the *Astrogram.* When submitting stories or ads for publication, submit your material, along with any questions, in MS word by e-mail to: astrogram@mail.arc.nasa.gov on or before the deadline.

Deadline	*Publication*
Mon, Jul 2	*Mon, Jul 9*
Mon, Jul 16	*Mon, Jul 23*
Mon, Jul 30	*Mon, Aug 6*
Mon, Aug 13	*Mon, Aug 20*
Mon, Aug 27	*Mon, Sep 3*
Mon, Sep 10	*Mon, Sep 17*
Mon, Sep 24	*Mon, Oct 1*
Mon, Oct 8	*Mon, Oct 15*
Mon, Oct 22	*Mon, Oct 29*
Mon, Nov 5	*Mon, Nov 12*

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